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Transformation of a Software Development Organization Using Software Acquisition Principles: A Case Study

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Agenda

- Background
- Outline of SEI Study Results
- The Transformation
- Results



Background

- Late 2001: Air Force leadership requested that the SEI conduct a brief probe to investigate software quality problems with the newly released Military Personnel Data System (MilPDS).
 - many airmen experienced pay problems
 - personnelists complained of poorly functioning software with a constant flow of patches/fixes
- Development, fielding, and sustainment of MilPDS was owned by an office within the Air Force Personnel Center (AFPC).
 - no acquisition/programmatic oversight or true Program Management
 - development budget/resources “taken out of hide”
 - indistinct line between “customer” and “developer”
- Late 2002: the SEI conducted a six-week, intensive study
- 2004: the SEI returned to conduct a follow-on study



SEI Study Results¹

- Requirements
 - requirement to “make it look like legacy”
 - no clear requirements management process
 - no distinction/differentiation between defects and new requirements/enhancements
 - advantages of powerful ERP systems not recognized or used
- Data
 - data irregularities handled on case-by-case basis, with little effort to identify larger patterns or root causes
 - data migrated from legacy system was not clean, causing problems in implementation of MiLPDS
- Engineering Processes
 - no one owned software development process
 - multiple teams used multiple processes; in some cases, competing processes existed
 - gaps in process, no process documentation



SEI Study Results²

- Deployment/Support Processes
 - limited/incomplete testing, focused largely on “happy path”
 - typical testers not qualified/experienced
 - little to no CM – code deployed without controls; constantly issuing emergency patches, which frustrated customers and introduced new defects
- Products
 - heavily customized COTS software implementation (modified source code)
 - 3M+ SLOC, with little/no documentation (user manuals, design, code standards, etc.)
 - database platform approaching obsolescence, hampering supportability/maintainability
 - relationship with COTS vendor not actively maintained



SEI Study Results³

- Personnel & Management
 - not enough personnel with the appropriate skills/training in development, test, etc.
 - majority of personnel “blue-suiters” who would soon rotate out; combined with lack of documentation, led to supportability problems
- Acquisition
 - funding taken “out of hide”
 - programmed funding for future development/sustainment was not evident



Key SEI Recommendations: 2001

- ❖ Reinstall
full program management
a technical lead/system architect with authority
- ❖ Secure a long-term funding line
for continued development
for technology refresh
for sustainment
- ❖ Consider the organizational implications
Maintaining and evolving a COTS-based system is very different from the “old way.”
Old concepts of “maintenance” must be replaced by a new mindset of *operation* and *evolution*.
There will be major new releases for the life of the system.



Status of Key SEI Recommendations: 2002

Recommendation	Oct 02 Status*
<i>System/Process</i> Cease proliferation of releases	★
<i>System/Process</i> Define and use software processes	★
<i>Mgt/Training/Documentation</i> Conduct personnel skills assessment	★
<i>System/SW/Test</i> Base tests on requirements, mature processes, aggressively look for failures	★
<i>Documentation</i> Develop technical/functional documentation	★
<i>Data Cleansing</i> Validate data fields in MiLPDS	★

*Excerpted from internal status briefing chart, October 2002.



Transformation

- Reorganize
- Focus on repeatable development process with clear definition of stakeholder responsibilities
- Institute measurement program
- Implement requirements prioritization process
- Make changes for acquisition
- Create an acquisition strategy/dual responsibility strategy



Previous Organization

Pre-System Program Office (SPO):

- Air Force Personnel Center (AFPC), Directorate of Personnel Data Systems (DPD)
 - Responsible for development, maintenance, network operations, program management, security, system administration, architecture, engineering, database management, etc.
- AFPC, Directorate of Personnel Support (DPS)
 - matrixed to AFPC/DPD
 - Responsible for providing the functional requirement, operational test and evaluation, acceptance testing, documentation (Help screens)
- Activity Development Teams consisting of
 - functional
 - developer
 - tester



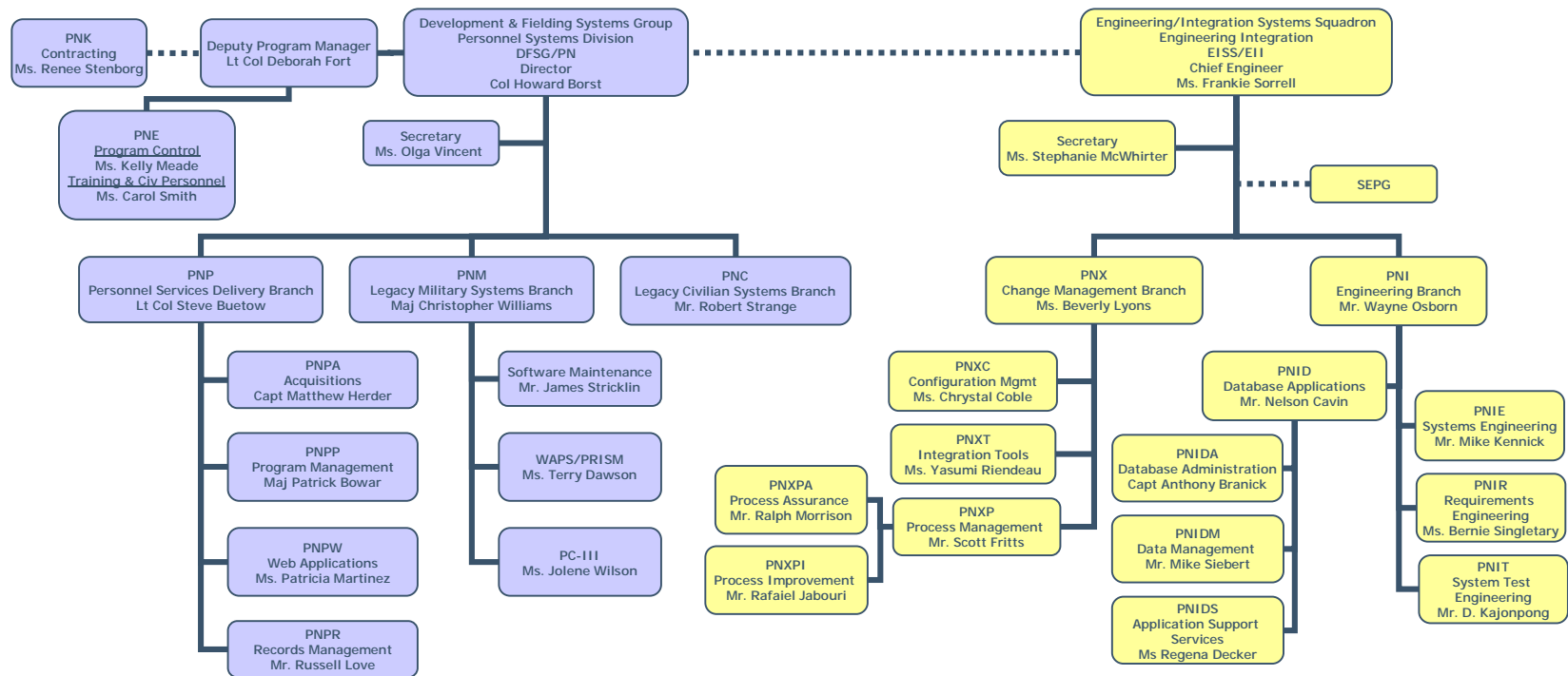
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Reorganization

SPO

- Performing true Acquisition Program Management
- Contracting
- Financial Management
- Development/Programming
- Engineering
 - Database Administration/Management
 - Technical Requirement Analysis
 - System/Integration Testing
 - Configuration Management
 - Quality Assurance





Repeatable Development Processes

- Organizational goal (“CMMI Level 2 in 2”)
- Re-chartered AFPC SEPG to SPO SEPG
 - Narrowed scope from improving AFPC business processes to defining MilPDS system maintenance processes
- Chartered Process Action Teams (PATs)
 - PAT performance was unsatisfactory
 - Placed functional managers as process owners—instant accountability
- Practitioners trained on new development processes
- Implemented QA audits on all MilPDS releases; identified non-compliance issues
- Performed series of SCAMPI appraisals to verify CMMI compliance
 - SCAMPI-C (Mar 05)
 - SCAMPI-B (July 05)
 - SCAMPI-A (Nov 05)

MilPDS Appraised at CMMI Level 2

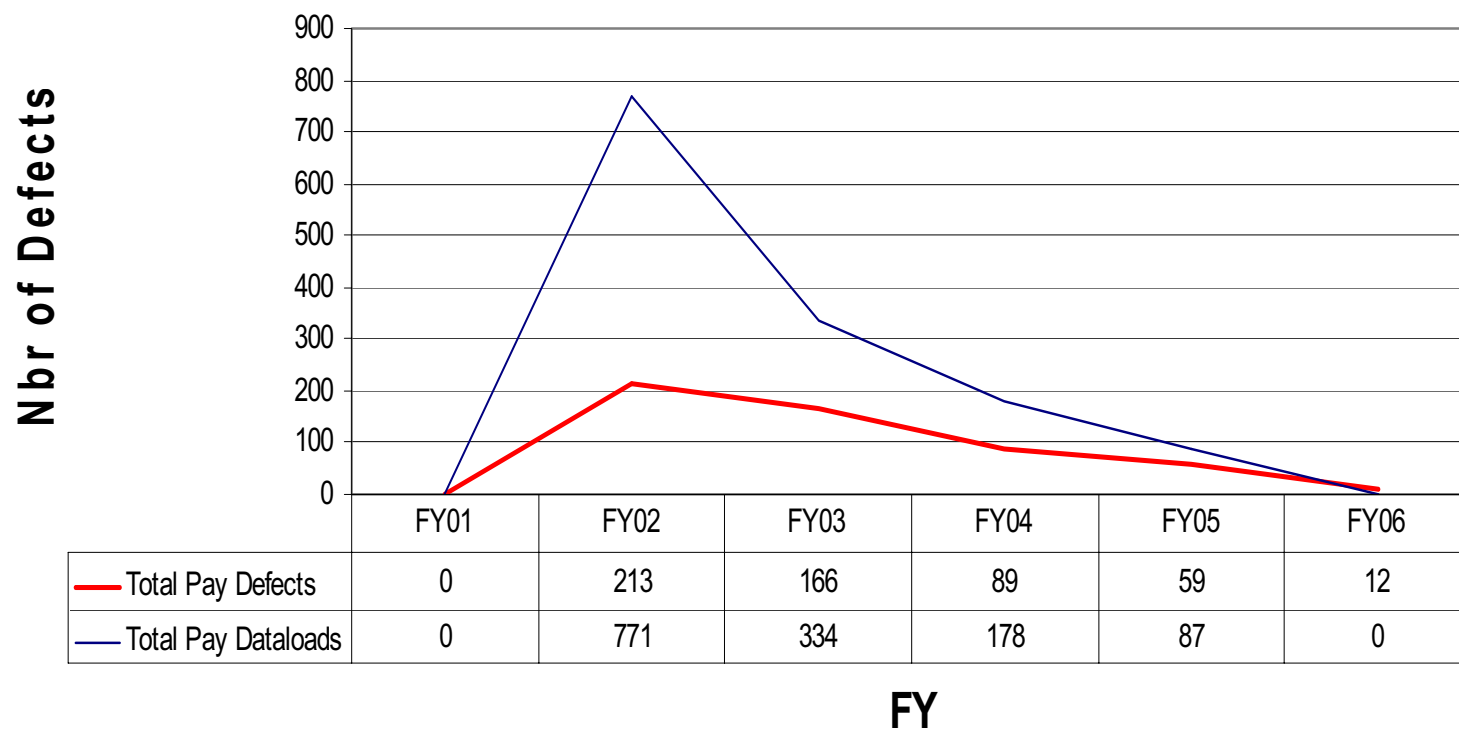


Measurement Program

- Established strategic goals at Leadership Summit Fall 2002
 - stabilize MilPDS
 - develop a quality team
 - posture for the future
- Implemented SEI-supported Goal-Driven Software Measurement
 - process compliance
 - resources and cost
 - product quality
 - process performance
- Measurements used for stabilization and performance
 - prepare for CMMI Level 2 SCAMPI
- Measurements scope expanded to other projects



MilPDS Pay Defects & Dataloads per FY (2001-2006)





Requirements Prioritization¹

- Customer has a responsibility to know their business, to communicate their needs, and to make tradeoffs
 - requirements liaison in place to “translate” customer needs
 - constant *negotiation*
- Facilitates expectation management and setting with customer/user community
 - Requirements Management Board briefed quarterly
 - SPO provides customer with status refresh daily
- Customer is responsible for ensuring that the need is reflected in priority order
 - fixed number of resources
 - continual policy changes in AF
 - continual technological advances to take advantage of



Requirements Prioritization²

Not everything can be Priority 1

- Customer participation
 - Requirements Management Board (RMB) process
 - “rack & stack”
 - continual *negotiation*
- SPO process
 - continual “churn” of analysis/programming
 - static and aggressive testing windows
 - configuration CONTROL
 - process assurance “cops”
- System Configuration Control Board
 - chartered to make decisions
 - approves baseline to all releases
 - uses risk management process to approve out-of-cycle requests



Changes for Acquisition

SPO Stand-up
Focus: Fix MiIPDS

- Absorbed analysis/programming staff
- Hired experienced/qualified Acquisition Program Managers
 - Absorbed program management staff
- Hired experienced/qualified Engineering Staff
 - Built a testing staff and implemented aggressive test program
- Hired experienced/qualified contracting officers
- Hired experienced/qualified financial managers
- Provided needed *training* (CMMI/SEI)



Acquisition Strategy

- Consolidation of contracts
- Aggressive contracting practices
 - correcting contracts awarded prior to SPO stand-up
 - following contracting processes for all future acquisitions



Results

SCAMPI appraisal in Nov 05

Program Director Goal of CMMI Level 2 in 2 years

2005 Shiely Award Winner – Best Program Office @ ESC

- **“Personnel systems problems evaporated, exceeded expectations...off CSAF Top 6”**
- **“Standardized requirements process, implemented integrated requirements toolset, ensured user priorities met”**
- **“222% reduction in new defects–69% reduction in total defects–achieved during 33% turnover in workforce”**
- **“Consistently used a Systems Configuration Control Board—a proven technical advisory for all system changes”**
- **“Improved functional office review process and configuration control process—Impact: higher quality analysis”**
- **“Transformed strategy; awarded 1st unit performance-based contract—now at 80%, exceeding 40% OMB goal”**
- **“ID’d technology ‘quick-wins’ to reduce customer workload—80% implemented immediately—now a ‘big win’”**



Key SEI Recommendations

Recommendation	Oct 02 Status	Apr 05 Status*	Apr 05 Comments*
<i>System/Process</i> Cease proliferation of releases	★	★	Release frequency changed; allows for more comprehensive testing
<i>System/Process</i> Define and use software processes	★	★	Change Management Process documented, SEPG leading CMMI Level 2 efforts
<i>Mgt/Training/Documentation</i> Conduct personnel skills assessment	★	★	Positional skill assessment complete; training program in development
<i>System/SW/Test</i> Base tests on requirements, mature processes, aggressively look for failures	★	★	Test process being scrubbed, 56% complete; updating/reviewing test processes; Rqmts, test cases, code will be linked with new tool (Oct-Nov 04)
<i>Documentation</i> Develop technical/functional documentation	★	★	Documentation of system requirements, code and test cases ongoing; sys rqmts 40%, code documentation started
<i>Data Cleansing</i> Validate data fields in MiIPDS	★	★	System supports data validation; DPS is POC for actual data cleansing

**Excerpted from internal status briefing chart, April 05.*



Closing Comments

- It's critical to have a few “champions” who “understand and get the job done” – they’ll show up in surprising positions and guises
- Senior leadership, top-down commitment, boss has to say AND do; emphasize accountability
- This isn't an overnight change – it didn't get bad overnight and you're not going to change it all in a day
- Hire qualified personnel and train the ones who aren't
 - supplement institutional knowledge with fresh new eyes



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